APPENDICES

A-1: Glossary

ACH: Air Changes per Hour.

ACH50: Air Changes per Hour at 50 Pascals.

ACHn: Air Changes per Hour natural.

Add-a-Hole Method: A diagnostic test involving adding a hole of known size to one side of the series leakage path and measuring the pressure differential before and after adding the hole to estimate overall zone leakage.

AFUE: Annual Fuel Utilization Efficiency—seasonal furnace or boiler efficiency.

AGA: American Gas Association.

Appliance: Any device powered by electricity designed for household use approved by the Division. A typical appliance would be a refrigerator.

ASHRAE: American Society of Heating, Refrigeration, and Air Conditioning Engineers.

Base Load Measures: Energy conservation measures that reduce the daily electrical use of the dwelling unit. An example of a base load measure is the installation of compact fluorescent lighting devices.

Basement: The substructure of a building, with the exterior walls forming the building foundation. Most of the basement is usually below ground. Wall heights vary, but are usually higher than 70 inches. In Wisconsin, the basement is often the combustion appliance zone. If the basement is unintentionally heated by the ducts or pipes the work done on the basement is sealing and insulating the box sill and sealing any large opening in the exterior walls. If the basement is intentionally heated, the walls may be insulated on the exterior, based how much is above grade exposure, and the results of modeling the building with the NEAT audit. See Sections 1.1.5 Exterior Foundation Insulation and 1.5 Floor and Foundation Insulation for more information on treatments.

BTU: British thermal unit.

BTUH: BTU consumption per hour.

CAZ: Combustion appliance zone.

CFL: Compact fluorescent lamp.

CFM: Cubic feet of airflow per minute.

CFM_{50}: Cubic Feet of airflow per minute @ 50 Pascals.

CO: Carbon Monoxide.

CO_2: Carbon Dioxide.

Combustion Appliance Zone (CAZ): The area where vented combustion appliances are located. The zone can be located inside or outside the pressure boundary.

Comfort Sealing: Air-sealing work for the primary purpose of removing drafts, which is performed at the direction of the dwelling unit's occupant. Comfort sealing is performed when blower door testing cannot be performed. When blower door testing cannot be performed, sealing work is limited to: attic bypass and key juncture sealing, glass replacement, and up to one work hour of comfort sealing.

Completed Measure: A measure installed in accordance with all standards and specifications in this manual.

Completed Unit: A dwelling unit that has received all the appropriate weatherization measures required by the measures list or computerized audit.

Computerized Audit System: The energy audit approved by the Division for use on 1- to 4-unit buildings and mobile homes.

Conditioned: Heated or cooled by a heating or cooling system at the expense of the occupants.

Crawl Space: An unfinished space under the floor of a building. The exterior walls are usually no higher than 40 to 50 inches. Most crawl spaces have dirt floors. Access hatches sometimes are in the basement through a common wall or in an outside foundation wall. This area often contains plumbing, wiring, and ductwork. Access to this space is usually limited to servicing the plumbing, wiring, or ductwork. The decision on where to insulate in a crawl space depends on if plumbing or ductwork runs through the space. If it does, usually the outside walls and box sill are sealed and insulated using rigid insulation, fiberglass batts, or two-part foam, rated for the application. In unheated crawl spaces, without ducts and pipes, the box sill and floor of the building are sealed and insulated, often with blown cellulose or fiberglass batts. A continuous moisture barrier must be installed if the crawl space has a dirt floor. See Sections 1.1.4 Interior Foundation Insulation, 1.1.5 Exterior Foundation Insulation and 1.5 Floor and Foundation Insulation for more information on treatments.

CRF: Cannot Reach Fifty – Blower Door procedure when 50 Pascals cannot be reached

Damaged Materials: Materials specifically assigned or designated for a specific dwelling unit/job and are damaged and made unusable either during transit to the job site or at the job site.

DOE: The United States Department of Energy.

Energy Audit: An inspection of the dwelling unit documenting its conditions from a thermal, structural, appliance, lighting, and safety perspective. This may be based on Required Measures List or the Division approved software program that generates a list of recommended weatherization measures for the dwelling unit, according to the software program's specifications.

Energy Conservation Measures (ECMs): The measures installed in a home that return energy cost savings. ECM measures are in contrast with Health and Safety and Repair measures that do not return an energy cost savings benefit.

ENERGY STAR®: An EPA/DOE program providing incentives for manufacturers to make energy-efficient products and encouraging consumers to buy these products.

EPA: Environmental Protection Agency

Final Inspection: The inspection performed on a dwelling unit by a non-crew member. The final inspection follows the completion of on-site work. The final inspection must be performed before the owner can sign off.

Friable Asbestos: Any asbestos-containing product that can be crumbled, pulverized, or reduced to powder by hand pressure.

GFCI: Ground fault circuit interrupter.

Guideline Sealing: Sealing work completed using the Weatherization Cost-Effective Sealing Guidelines, that includes sealing work between the house and the outside. This work often addresses infiltration sealing, air coming in low in the building.

Heating Costs: Costs of any source of heating in a dwelling unit used for residential heating purposes. All heating costs for commercial, business or any purpose other than the dwelling unit of the applicant are excluded.

Home Energy: All fuel sources used in a dwelling unit. It includes all heating costs and non-heating costs. Non-heating costs are often referred to on utility bills as base load costs (the base costs before heating costs are included).

HVAC: Heating, ventilation, and air conditioning.

IFGC: International Fuel Gas Code.

Infiltration: The uncontrolled air entering the building, usually at the lower portion of the building.

IWC: Inches of water column—a measurement of pressure.

Key Junctures: Junctions between building components, which require careful sealing and/or insulating, (e.g., wall-floor junctions).

kW: Kilowatt—a measurement of electrical power.

kWh: Kilowatt hour—a measurement of electrical use.

Lead Based Paint: Paint that has a lead content of not less than 0.06% by weight or.7 milligrams per sq. cm.

Lead Safe Working Conditions: Conditions that meet the OSHA and EPA requirements for adequate protection from lead exposure for both the building occupants and the workers performing the weatherization activities.

Make-up Air: Air let into the home intentionally to make up for air being exhausted out of the home by exhaust fans or chimneys.

Manual J: The ASHRAE method of calculating building heat loss.

MHEA: Mobile Home Energy Audit— Energy audit software by DOE for prioritizing weatherization.

MSDS: Material safety data sheet, describing the hazards of a material.

NEAT: National Energy Audit Tool— Energy audit software by DOE for prioritizing weatherization.

Non-Guideline Sealing: Major air-sealing work needed prior to other shell-measure activities.

NFPA: National Fire Protection Association.

OSHA: Occupational Safety and Health Administration.

pa: Pascal.

Pascal: Metric unit of pressure.

ppm: Parts per million.

Pressure Boundary: The air barrier of a home.

psi: Pounds per square inch.

PVC: Polyvinyl chloride—material used in PVC pipe and plastic sheeting.

SEER: Seasonal Energy Efficiency Ratio—a measurement of air-conditioning efficiency.

Short Basement: A cross between a crawl space and a basement. Short basements often have dirt floors and access doors in the floor or the exterior of the building. The exterior walls of this space are usually higher that 40 inches but shorter that 78 inches. The dimensions may vary within the basement. This space often contains the building's heating and water heating equipment. Access to the space is primarily to service the equipment. If the short basement is unintentionally heated by the ducts or pipes the work done on the short basement is sealing and insulating the box sill and sealing any large opening in the exterior walls. If the short basement is intentionally heated, the walls may be insulated on the exterior, how much is above grade, and the results of modeling the building with the NEAT audit. The decision on installing a moisture barrier should be made based on the site conditions. *See Chapter 1.5 Floor and Foundation Insulation for more information. See Sections 1.1.5 Exterior Foundation Insulation and 1.5 Floor and Foundation Insulation for more information on treatments.*

Sone: Measurement of noise used in rating exhaust fans.

SSE: Steady State Efficiency.

TESP: Total Exterior Static Pressure.

UDC: Wisconsin Uniform Dwelling Code.

Ventilation: The intentional exchange of indoor air with outdoor air to remove pollutants, especially moisture.

Venting: The flues, vent connector, and chimney that exhausts combustion gases out of the home.

WCEG: Weatherization cost-effective guidelines for air sealing.

WRT: With reference to.

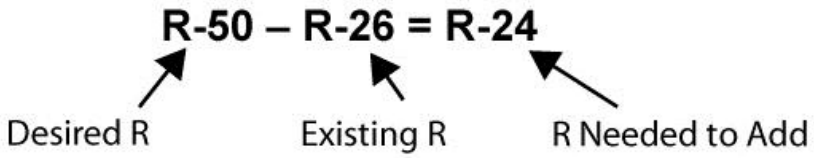
A-2: R-Values for Common Materials

Material	R-value
Fiberglass or rock wool batts and blown 1″	2.8–4.0
Blown cellulose 1″	3.0–4.0
Vermiculite loose fill 1″	2.7
Perlite 1″	2.4
White expanded polystyrene foam (beadboard) 1″	3.9–4.3
Polyurethane/polyisocyanurate foam 1″	6.2–7.0
Extruded polystyrene 1″	5.0
Sprayed 2-part polyurethane foam 1″	5.8–6.6
Icynene foam 1″	3.6
Oriented strand board (OSB) or plywood $^{1}/_{2}$″	1.6
Concrete or stucco 1″	0.1
Wood 1″	1.0
Carpet/pad $^{1}/_{2}$″	2.0
Wood siding $^{3}/_{8}$–$^{3}/_{4}$″	0.6–1.0
Concrete block 8″	1.1
Asphalt shingles	0.44
Fired clay bricks 1″	0.1–0.4
Gypsum or plasterboard $^{1}/_{2}$″	0.4
Single pane glass $^{1}/_{8}$″	0.9
Low-e insulated glass (Varies according to Solar Heat Gain Coefficient (SHGC) rating.)	3.3–4.2
Triple glazed glass with 2 low-e coatings	8.3

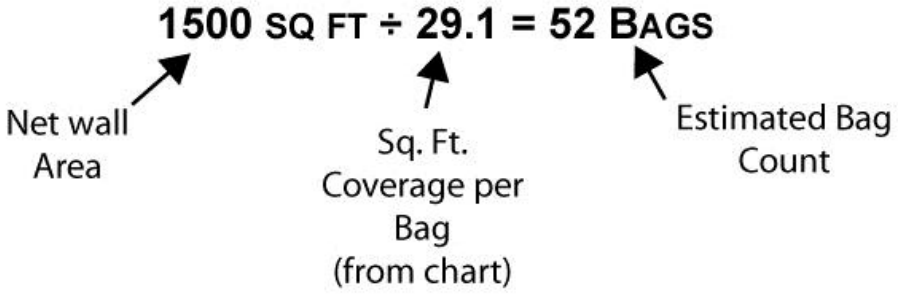
A-3: Insulation – Density Calculations

Example: Calculating number of bags

Step 1: Calculate area of attic:
Multiple length times width of the attic to get the area of attic.



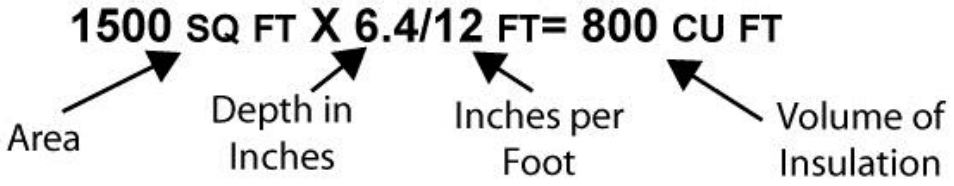
Step 2: Calculate R-value that you need to add:
Subtract existing R from desired R to get the R-value you need to add.



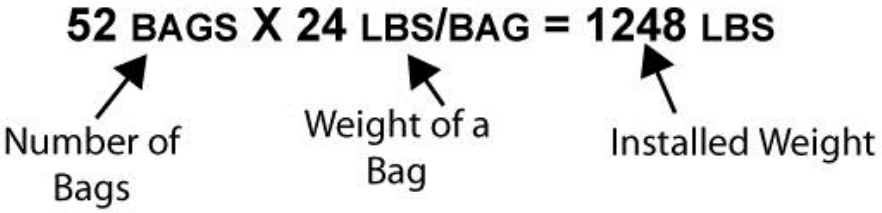
STEP 3: Calculate bag count:

Divide area of attic by coverage per bag from the chart on the bag to get your Estimated Bag Count.

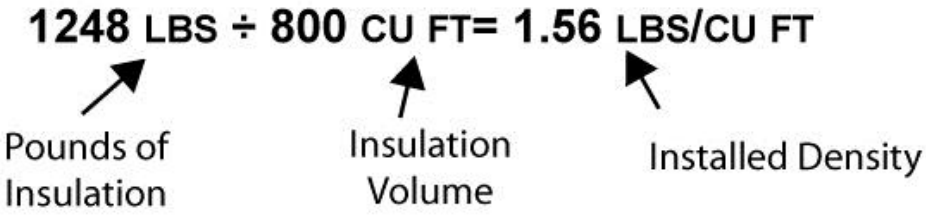
Attic Insulation – Calculating Density



Step 1: Calculate volume of installed insulation:
Multiple area times depth of the attic insulation to get the volume of insulation.



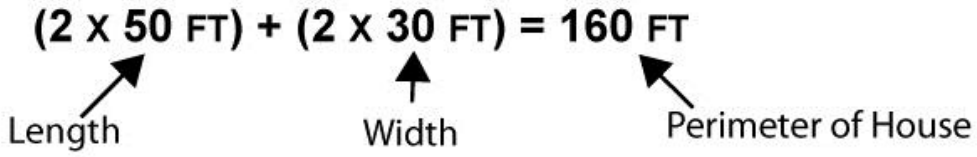
Step 2: Calculate the weight of insulation you installed:
Take the number of bags times the weight per bag to get the total weight.



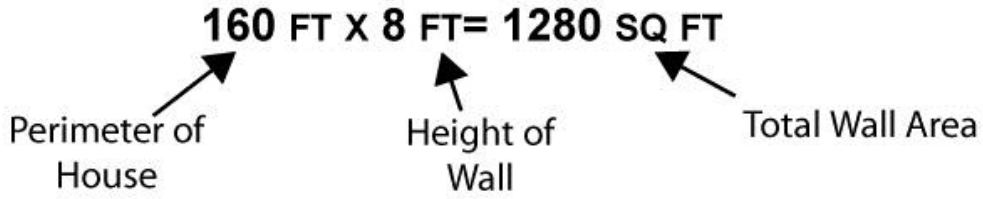
STEP 3: Calculate density of installed insulation:
Divide pounds of insulation by cubic feet of insulation volume to get density.

Note: Density should be between 1.3 and 2.0 pounds per cubic foot or conform to manufacture's specifications for density, coverage, and bag count for the desired R-value.

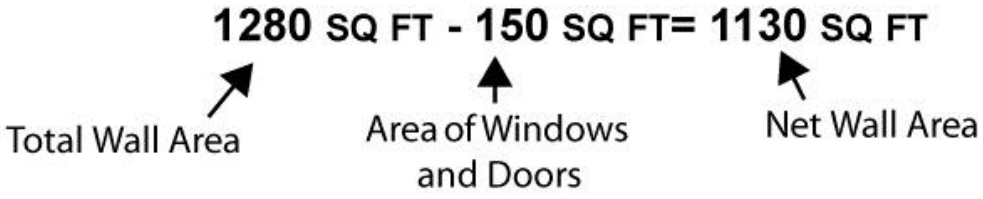
Wall Insulation – Calculating Number of Bags



STEP 1: Calculate perimeter of house:
Calculate the perimeter of the house. If the house is a simple rectangle or near a simple rectangle, use the formula above. If the house has numerous unequal sides, simply add the lengths together to find the perimeter.

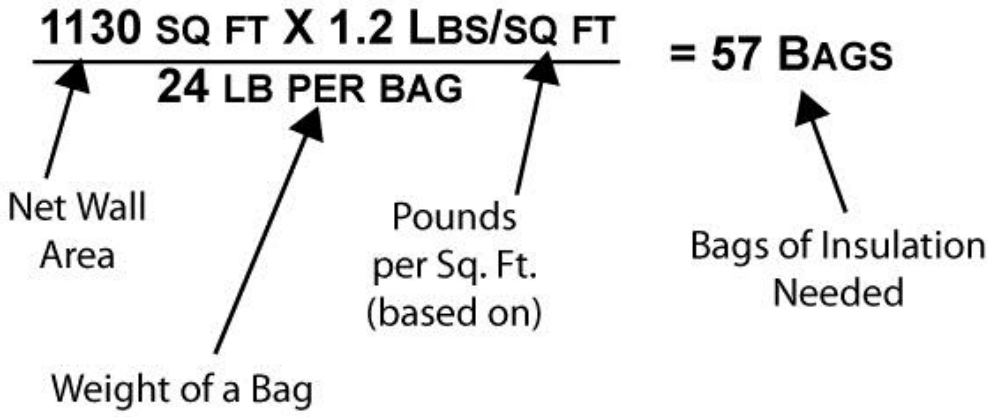


STEP 2: Calculate total wall area:
After calculating the perimeter of the house, multiply it times the wall height. This will give you the total wall area.



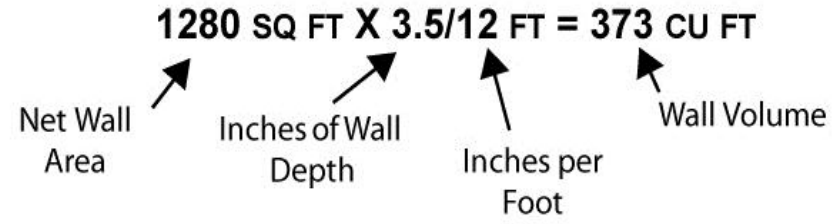
STEP 3: Calculate net wall area:
Calculate the sum of the areas of windows and doors. Subtract them from the total wall area to get net wall area.

Wall Insulation – Calculating Number of Bags (Continued)

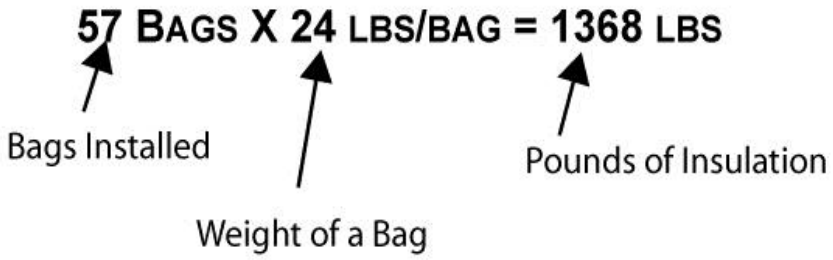


STEP 4: Calculate bag count: Multiply net wall area by 1.1 to 1.5 pounds per square foot for a 2-by-4 wall. Then divide by the number of pounds per bag to get the bag count.

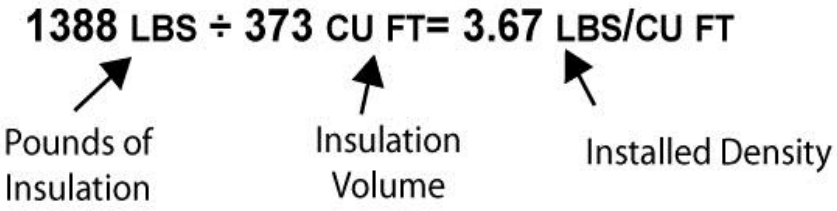
Wall Insulation – Calculating Density



STEP 1: Calculate wall volume:
Multiply the wall's surface area times the depth on the wall cavity converted to feet.



STEP 2: Calculate weight of insulation:
Multiply number of bags you installed times the weight of a single bag to get the weight of the installed insulation.



STEP 3: Calculate density of installed insulation:
Divide pounds of insulation by cubic feet of insulation volume to calculate density.

A-4: General Information on Spray Polyurethane Foam (SPF)

Low-Pressure SPF

Low-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in pressurized canisters (~250 psi), dispensed through unheated hoses through a disposable mixing nozzle system, and applied as a froth-like material to substrate. This type of SPF product is typically used for air sealing and small-scale insulation projects and most commonly come in 200 or 600 board foot disposable kits.

High-Pressure SPF

High-pressure SPF systems are two-component polyurethane foam products. They are typically delivered to the job site in unpressurized drums or totes, and dispensed by a proportioner pump where heat and pressure are added. These chemicals travel through heated hoses to a spray gun where the material mixes and is aerosolized during application. This type of SPF product is typically used for larger insulation applications.

Once installed, there is essentially no difference in product performance between low- and high-pressure foams. It should be noted that the main differences between the two types of systems are the application rate, PPE requirements, air borne concentrations of chemicals during application, and capital equipment investment.

Applicators should obtain training from the suppliers of SPF to help assure installation quality and use of all equipment as well as safe handling, use, and disposal of all chemicals used in the process. Spray Polyurethane Foam Alliance (SPFA) also offers additional resources for low and high-pressure SPF products.

Safety and Application

During application of SPF products chemicals are released into the air during the mixing of the chemicals. Chemical fumes can be inhaled and chemical dust can be absorbed through the skin making proper ventilation and appropriate PPE critical in preventing exposure to the applicator. Exposure to SPF chemicals can occur even at low exposure levels. Customers should be informed about the use of SPF products in their home, and installers should be well informed about the procedures used to keep them safe. Employers must assure compliance with OSHA's hazard communication requirements. Customer's belongings must be protected from overspray during use, and the substrate that the foam is being applied to must be free of excessive dirt as the foam will expand in all directions. If the area is not properly prepared prior to application the foam may not adhere or can pull away from the surface.

Manufacturer Installation Instructions

SPF applicators should follow all manufacturer installation instructions for the product being used. These instructions include product-specific documents such as application instructions, Safety Data Sheets (SDS), and evaluation reports.

A-5: Field Guide Modifications

Date	Description	Page(s)